

# Philips Medical Systems

## CANpro CAN Test Tool User's Guide

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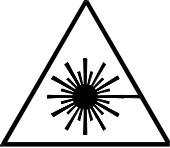


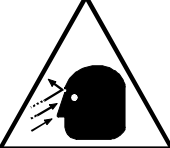
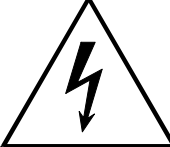
# PHILIPS

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## SYMBOL DESCRIPTIONS

	Attention symbol.		Radiation warning symbol.
	Laser warning symbol.		Biohazard warning symbol.
	Magnetism warning symbol.		Projectile warning symbol.
	Electrical warning symbol.		

## REVISION HISTORY

REVISION	DATE	COMMENTS
-I	04/02/01	Preliminary issue. Based directly from on-line help files in CANpro.
<b>A</b>	06/07/01	Removed developer mode information per Haifa review, added MMSIL P/Ns. Original release.
<b>B</b>	12/04/01	Revised Title Page with Philips Logo and proprietary statement.

## CANpro CAN Test Tool Installation Instruction

### NOTICE

THE INFORMATION CONTAINED IN THIS MANUAL CONFORMS WITH THE CONFIGURATION OF THE EQUIPMENT AS OF THE DATE OF MANUFACTURE. REVISIONS TO THE EQUIPMENT SUBSEQUENT TO THE DATE OF MANUFACTURE WILL BE ADDRESSED IN SERVICE UPDATES DISTRIBUTED TO PHILIPS MEDICAL SYSTEMS (CLEVELAND), INC. TECHNICAL SERVICE ORGANIZATION.

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EXCEPT FOR INSTALLATIONS REQUIRING CERTIFICATION BY THE MANUFACTURER PER FEDERAL STANDARDS, SEE THAT A RADIATION PROTECTION SURVEY IS MADE BY A QUALIFIED EXPERT IN ACCORDANCE WITH NCRP 102, SECTION 7, AS REVISED OR REPLACED IN THE FUTURE. PERFORM A SURVEY AFTER EVERY CHANGE IN EQUIPMENT, WORKLOAD, OR OPERATING CONDITIONS WHICH MIGHT SIGNIFICANTLY INCREASE THE PROBABILITY OF PERSONS RECEIVING MORE THAN THE MAXIMUM PERMISSIBLE DOSE EQUIVALENT.

### Diagnostic Imaging Systems - MECHANICAL-ELECTRICAL WARNING

ALL OF THE MOVEABLE ASSEMBLIES AND PARTS OF THIS EQUIPMENT SHOULD BE OPERATED WITH CARE AND ROUTINELY INSPECTED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS CONTAINED IN THE EQUIPMENT MANUALS.

ONLY PROPERLY TRAINED AND QUALIFIED PERSONNEL SHOULD BE PERMITTED ACCESS TO ANY INTERNAL PARTS. LIVE ELECTRICAL TERMINALS ARE DEADLY; BE SURE LINE DISCONNECTS ARE OPENED AND OTHER APPROPRIATE PRECAUTIONS ARE TAKEN BEFORE OPENING ACCESS DOORS, REMOVING ENCLOSURE PANELS, OR ATTACHING ACCESSORIES. DO NOT UNDER ANY CIRCUMSTANCES, REMOVE THE FLEXIBLE HIGH TENSION CABLES FROM THE X-RAY TUBE HOUSING OR HIGH TENSION GENERATOR AND/OR THE ACCESS COVERS FROM THE GENERATOR UNTIL THE MAIN AND AUXILIARY POWER SUPPLIES HAVE BEEN DISCONNECTED. FAILURE TO COMPLY WITH THE ABOVE MAY RESULT IN SERIOUS OR FATAL BODILY INJURIES TO THE OPERATOR OR THOSE IN THE AREA.

### ELECTRICAL-GROUNDING INSTRUCTIONS

THE EQUIPMENT MUST BE GROUNDED TO AN EARTH GROUND BY A SEPARATE CONDUCTOR. THE NEUTRAL SIDE OF THE LINE IS NOT TO BE CONSIDERED THE EARTH GROUND. ON EQUIPMENT PROVIDED WITH A LINE CORD, THE EQUIPMENT MUST BE CONNECTED TO PROPERLY GROUNDED, THREE-PIN RECEPTACLE. DO NOT USE A THREE-TO-TWO PIN ADAPTER.

### Diagnostic Imaging Systems - RADIATION WARNING

X-RAY AND GAMMA-RAYS ARE DANGEROUS TO BOTH OPERATOR AND OTHERS IN THE VICINITY UNLESS ESTABLISHED SAFE EXPOSURE PROCEDURES ARE STRICTLY OBSERVED.

THE USEFUL AND SCATTERED BEAMS CAN PRODUCE SERIOUS OR FATAL BODILY INJURIES TO ANY PERSONS IN THE SURROUNDING AREA IF USED BY AN UNSKILLED OPERATOR. ADEQUATE PRECAUTIONS MUST ALWAYS BE TAKEN TO AVOID EXPOSURE TO THE USEFUL BEAM, AS WELL AS TO LEAKAGE RADIATION FROM WITHIN THE SOURCE HOUSING OR TO SCATTERED RADIATION RESULTING FROM THE PASSAGE OF RADIATION THROUGH MATTER.

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THOSE RESPONSIBLE FOR PLANNING OF X-RAY AND GAMMA-RAY EQUIPMENT INSTALLATIONS MUST BE THOROUGHLY FAMILIAR AND COMPLY COMPLETELY WITH NCRP NO. 49, "STRUCTURAL SHIELDING DESIGN AND EVALUATION FOR MEDICAL OF X-RAYS AND GAMMA-RAYS OF ENERGIES UP TO 10 MEV", AS REVISED AND REPLACED IN THE FUTURE. FAILURE TO OBSERVE THESE WARNINGS MAY CAUSE SERIOUS OR FATAL BODILY INJURIES TO THE OPERATOR OR THOSE IN THE AREA.

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## INTRODUCTION TO CANPRO

The **CANpro** CAN Test Tool is a powerful tool for the development and execution of reproducible tests cases for CT machines that use CAN as internal communication bus between micro controllers.

**CANpro** can be used for executing test scenario files that help you locate defects and errors on a CT scanner. All files that describe the actual model of the scanner are located on the scanner's host computer. At test start, you connect the **CANpro** PC to the host by an ethernet link and provide the IP-address of the host. Then **CANpro** connects, downloads and encrypts all these files for you. All files are stored locally using a machine name you define as the directory.



### **WARNING**

**NEVER USE THE SAME MACHINE NAME FOR TWO DIFFERENT MACHINES.**

**CANpro** provides three function groups:

- **CAN Telegram Monitoring**
- **CAN Telegram Simulation**
- **Flash Load**



## GENERAL DESCRIPTION

### GETTING STARTED

1. Before starting **CANpro**, make sure that the **CAN dongle** as well as the **security dongle** are connected.
2. If you want to work with a scanner machine, you need an ethernet connection to the host of the scanner machine. You also need to know the IP address of the host.
3. You also need a CAN bus connection from the CAN dongle to the machine itself.
4. At **CANpro** start, you are asked to select a machine.
5. You can select an existing machine description, or you can define a new machine name.
6. The existing machine description needs to match the scanner machine **CANpro** is connected to, so choose this option only if you are sure you have downloaded this machine description before when you connected to the same machine!
7. **CANpro** synchronizes the machine description with the host. This means, it does an FTP download of scenarios, description files, HTML error files etc. corresponding to this particular machine.
8. **CANpro** connects also to a socket on the host for special purposes:
  - Synchronization of **time stamp**
  - Using the host **Thermal Load Calculator** for avoiding damages to the x-ray tube

Both virtual connections to the host need to be successful for **CANpro** to execute all its functionality in the safest possible way.

**You will not be able to do scans with x-ray under any of the following conditions:**

- The FTP download of files was not successful
- The existing machine description you selected is not identical to the one on the scanner machine's host
- The socket connection to the host's Thermal Load Calculator could not be established.

If there are any fatal problems with the machine description you are trying to use, any connection problems, important description files missing, or others, you may need to choose an existing machine description. All files that you normally need will be found on the scanner machine's host. In case the console of the machine you are connecting to is not on line, you can use the MX8000 default description and choose "No synchronization". It is not possible to choose MX8000 default description and download the files from host (to overwrite it).

**CAN Dongle:**

The PEAK PCAN driver is installed with **CANpro** software. This driver by PEAK GmbH supports the PEAK CAN dongle you have received together with **CANpro**. For installation details see the installation manual.

**CANpro** configures the CAN dongle's **CAN parameters** according to the settings for the current machine. You do not need to change them.

**WARNING**

**YOU SHOULD NOT REMOVE THE PEAK CAN DONGLE WHILE WINDOWS NT IS RUNNING !!!**

**Security Dongle or Security Software:**

You need either a security dongle connected to one of your PC's parallel ports (received together with the software) or K2000 security software enabled with valid machine codes. See **Figure 1**.

If you use a security dongle with the PEAK CAN dongle, you may connect both to the same parallel port:

1. Connect the security dongle to the parallel port
2. Connect the PEAK CAN dongle to the security dongle and to the PS/2-Port (or DIN port).

If you have security software K2000 enabled, you can connect the PEAK CAN dongle directly to the parallel port. No special hardware is needed. The following two conditions must be met to run **CANpro** using K2000 security software:

- K2000 must be authorized with valid machine codes.
- The registry must be updated with the current list of K2000 authorized files that includes CANpro.exe.

Machine codes and the current registry list are obtained by logging in to Service and running the update function for each.

**CAN Cards and Drivers:**

The **CANpro** CAN Test Tool can use a variety of CAN communication cards. The PEAK PCAN driver is installed with **CANpro** software. This driver by PEAK GmbH supports the following devices:

- PCAN-Dongle I I/29 BIT ID
- PCAN-Dongle Pro I I/29 BIT ID
- PCAN-ISA board I I/29 BIT ID
- PHYTEC ISA board (max 4 CAN controllers optically uncoupled) I I/29 BIT ID
- PCAN-PC-I04 (max 2 CAN controllers optically uncoupled) I I/29 BIT ID
- PCAN PCI board I I/29 BIT ID
- PCAN USB Interface I I/29 BIT ID

The PEAK CAN dongle is used under normal conditions. For PEAK CAN driver installation details, see the **CANpro** CAN Test Tool installation manual (P/N T55E-1305, MMSIL P/N 491-7181-3808).

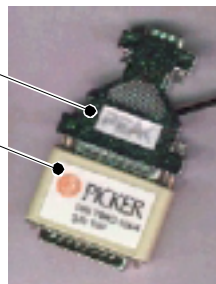
**CANpro** configures the CAN card's CAN parameters according to the settings for the current machine.

**WARNING**

**YOU SHOULD NOT REMOVE THE CAN COMMUNICATION CARD  
(E.G., THE PEAK CAN DONGLE) WHILE WINDOWS NT IS RUNNING  
!!!**

PEAK Dongle-CAN

Security Dongle

**Security Dongle or Security Software**

You must have one of the following:

a security dongle attached to the parallel port of the PC running **CANpro**

K2000 security software installed and enabled.

**FIGURE 1** Security Dongle and PEAK CAN Dongle piggyback

## SAFETY ASPECTS OF CANPRO USE



### **WARNING**

**NEVER USE CANPRO FOR MAKING CT SCANS OF PERSONS!**

In the present release of **CANpro**, you can execute many kinds of test scenarios that are written according to the syntax of **CANpro**'s simulation language.

The Thermal Load Calculator is now being used to avoid damages to the x-ray tube - it does not allow to execute scenarios that damage the MX8000's x-ray tube.

But even with the tube heat calculator working, please remember that **CANpro** is a test tool:

- Only execute test scenarios if you understand what they mean and for which purpose they have been written
- If a test scenario contains x-ray producing commands, be sure that nobody is in the scanner room when you execute it.

## HOW DOES CANPRO RUN IN REAL-TIME ON WINDOWS 98/ME/NT/2000?

The **CANpro** CAN Test Tool is designed to **run in real time on Microsoft Windows NT/2000**.

Is Windows NT a real time system? One may think so because it is certainly a multiprocessing system and several processes and threads can be running at the same time. The system has a scheduler that distributes time slices to the processes and threads.

Time slices on a Windows NT system have a standard duration of 20-30 ms. Threads have a dynamic priority that is constantly being changed as a consequence of waiting for system resources (and other things) even though you can assign a base priority to each thread. Running processes compete for system resources and processor time. Only thread(s) with the highest dynamic priority are served at a time. Windows NT scheduling is unpredictable. It cannot be guaranteed that a certain application gets enough processor time when or as often as needed if several processes are running on the same system. Even hardware interrupts are being scheduled if several of the same priority happen to be served at the same time. Windows NT can meet "soft" real time needs only if the real time program does not need to run together with other software not designed for this kind of situation. The same applies to Windows 98/ME, but the time slices can be shorter.



### CAUTION

TO ACHIEVE ACCEPTABLE REAL TIME BEHAVIOR, DO NOT RUN OTHER APPLICATIONS IN PARALLEL WITH **CANPRO** WHILE **CANPRO** IS MONITORING, FLASH LOADING OR DURING SIMULATION. FOR THE SAME REASON, YOU SHOULD NOT USE A SCREEN SAVER.

### Real time needs of CANpro

The time limits **CANpro** is dealing with are on the order of a few **milliseconds**. Having more than a few telegrams wait for processing at any one time is avoided whenever possible even though they are stored in a CAN driver ring buffer and have already received a time stamp. Ideally, **CANpro** writes the telegram to the protocol file in about the same millisecond it was received. **CANpro** must respond within 50 ms to any telegrams received regardless of how fast they may appear at the CAN dongle during simulation. **CANpro** needs "soft" real time. Therefore, we have given the whole **CANpro** process a **higher priority class** to avoid big "time robbing" by time-consuming applications running in parallel.

Nevertheless, even lower-level applications will be executed once they have waited long enough to get their priority-boost, and parts of them may be executed on a higher priority level when they make system calls. Disk I/O, for example, is using hardware interrupts, which have a much higher priority level than any user application can have.

## THERMAL LOAD CALCULATOR (HEAT CALCULATOR, TLC)

### Why do we need it?

Due to the physics of the x-ray tube, it is required that the amount of energy stored in the x-ray tube be estimated and controlled in order to prevent the x-ray tube from suffering physical damage related to over heating. Thus, before more energy is applied to the tube, via an X-ray shot, an estimate of the tube's future heat load is calculated. This calculation must take into account present heat load, time of last shot, the tubes physical parameters, as well as the desired shot's duration and energy level (KV and mA).

If a sequence of multiple shots are required, then an understanding of the energy levels of each shot, duration of each shot along with time period between shots must be taken into account as well as the x-ray tube's present heat load condition.

### How do we use it?

**CANpro** uses automatically the built-in Thermal Load Calculator of the scanner machine host - if it is connected to it. It analyzes the **test scenarios** as well as the values you can enter in the **Manual X-Ray Dialog**, while the scan parameters are being loaded to the gantry.

It uses this information for asking the TLC for scan permission before sending an "SE" (Scan Execute) command to the gantry.

If a scan is **not allowed at the moment**, a count down dialog box is displayed, announcing the time in hours, minutes and seconds, that is needed to cool the tube sufficiently down to execute all scans that are defined in the currently loaded cycle table. After this, the TLC is asked again for scan permission.

If a scan is **not allowed at all**, an error message is displayed and the current scenario is stopped.

Then it checks the CAN telegrams that are returned by the gantry during the actual scan, and uses some of their parameters to update the TLC. Triggered by **CANpro**, the TLC calculates and stores internally always the current tube temperature as a result of executed scans and time passed since then.

You cannot execute scans with x-ray from **CANpro** if the laptop is not connected via ethernet to the host. However, you can start scenarios to get diagnostics, test movements, or do scans without x-ray.

**DEFINITIONS**

The following is a list of short definitions for terms encountered in this document:

- background protocol file:** A plain, ASCII format file created by the **CANpro** monitor. It contains all interpreted telegrams & comments regardless of the current telegram filtering options. The extension is “.fullcpf” (full **CANpro** Protocol File).
- bit type:** Type specifier used to describe parameters in command and table description files.  
**Parameters:**  
    <type> **bit\_type**  
        <unit> - (not significant)  
        <scale> - (not significant)  
        <no\_of\_bytes> 0  
        <byte\_addr> unsigned integer value  
        <bit\_addr> 0 to 7  
  
    **Values:** 0 (OFF) or 1 (ON).  
    **Operators:** ==, !=, val  
    These operators may be used in an expression in a scenario file with this type.
- block:** One or a sequence of scenario commands.  
    <block> ::=     <canpro\_command\_or\_structure>  
                  [ <canpro\_command\_or\_structure> ]\*
- comment:** Blank lines, any line beginning with a # or a / or any line with a # or a / as the first character after white space in a scenario or description file is treated as a comment and therefore ignored by **CANpro** when analyzing the file. Proposed convention: use # for comment texts and / to comment out lines of code!
- CAN Command:** Command interchanged between microcontrollers as a CAN telegram. The command name consists of one or two upper case letters, e.g., “E” or “AS” and is defined in the machine’s description files.
- CAN identifier:** Number between 0 and 2031 decimal (0x00 to 0x7ef hex) that expresses telegram priority. Each CAN telegram must have an identifier for the microcontroller to recognize the telegrams that it must read.

<b>cycle table:</b>	<p>Table sent to the Mx8000 gantry containing the sequence, cycle time, number of repetitions etc that should be executed and are defined in the mode table.</p> <p>The table is sent in CAN telegrams that start with T 0xf1 and T 0xf3.</p> <p>Therefore, this table is also called “TF1” respectively “TF3”.</p>
<b>Data Telegram:</b>	<p>CAN telegram interchanged between microcontrollers and other hardware such as Serial Link Input/Outputs (SLIOs). CAN telegrams have identifiers, zero to eight data bytes and are not interpreted by <b>CANpro</b>.</p>
<b>description:</b>	<p>File in plain ASCII format containing precise information about how <b>CANpro</b> should interpret telegram content i.e. identifiers, CAN commands, and parameters. The extension is “.dsc” (Description file).</p>
<b>float type:</b>	<p>Type specifier used to describe parameters in command and table description files.</p> <p><b>Parameters:</b></p> <ul style="list-style-type: none"> <li>&lt;type&gt; <b>float_type</b></li> <li>&lt;unit&gt; a string expressing a unit, like “m/s]” or “kV]”</li> <li>&lt;scale&gt; a float number</li> <li>&lt;no_of_bytes&gt; 1 to 4</li> <li>&lt;byte_addr&gt; unsigned integer value</li> <li>&lt;bit_addr&gt; 0 or - (not significant)</li> </ul> <p><b>Values:</b> neg. and pos. 64-bit float values, depending on size: 1 to 4 byte integer value multiplied with scale.</p> <p><b>Operators:</b> &gt;=, &lt;=</p> <p>Scenario files containing float type specifiers may use expressions containing these operators.</p>
<b>flash timeout: parameters</b>	<p><b>CANpro</b> uses these times to delimit how long it will wait for the FC and FV in Flash Load, and the time the controller may use for the transmission of the whole firmware block in Flash Read. The times are input in seconds. Minimum is 1s. For a whole block, at least 5s are needed. Perhaps a value of 50s will be useful. <b>Do not change the flash parameters unless there is a good reason to do so.</b> Times should be incremented if timeouts in flash reading or flash loading occur.</p>
<b>gantry_hardware: _firmware.cfg</b>	<p>A file that describes the current hardware - firmware configuration of a scanner. It contains a line giving controller name, hardware revision, and firmware version for each controller.</p>



<b>int_type:</b>	<p>Type specifier used to describe parameters in command and table description files.</p> <p><b>Parameters:</b></p> <ul style="list-style-type: none"> <li>&lt;type&gt; <b>int_type</b></li> <li>&lt;unit&gt; a string expressing a unit, like “m/s]” or “[kV]”</li> <li>&lt;scale&gt; a float number (should have integer value)</li> <li>&lt;no_of_bytes&gt; 1 to 4</li> <li>&lt;byte_addr&gt; unsigned integer value</li> <li>&lt;bit_addr&gt;0 or - (not significant)</li> </ul> <p><b>Values:</b> negative and positive 32-bit integer values: 1 to 4 bytes multiplied with the scale</p> <p><b>Operators:</b> ==, !=,&gt;=, &lt;=, &gt;, &lt;, val, &amp;</p> <p>Scenario files containing int type specifiers may use expressions containing these operators.</p>
<b>MCU filament current correction</b>	<p>“MCUFilamentFile.cfg” contains information that is changed according to the tube aging process of the particular scanner and is downloaded from the host if a connection exists. Mode table fragments containing the “filament current” parameter are replaced by actual values looked up from the host.</p>
<b>mode table:</b>	<p>Table sent to the Mx8000 gantry containing the parameters for all modes that should be executed. The table is sent in CAN telegrams that start with T 0xf0 and T 0xf2; therefore this table is also called “TF0” respectively “TF2”.</p>
<b>protocol file:</b>	<p>Plain file (extension = “.cpf” for <b>CANpro</b> Protocol File) in ASCII format created by <b>CANpro</b> containing interpreted telegrams and comments. Telegram identifiers may be used to filter out unwanted telegrams.</p>
<b>Remote Frame:</b>	<p>CAN telegram interchanged between microcontrollers and other hardware such as Serial Link Input/Outputs (SLIOs). Remote frames have no identifiers, contain no data and set the remote bit.</p>
<b>Scenario File:</b>	<p>File in plain ASCII format containing simulation commands and control structures to be executed by <b>CANpro</b> during simulation. The extension is “.tsc” (Test Scenario).</p>
<b>SLIO:</b>	<p>Serial Linked Input/Output. Special Hardware components that can send and receive data telegrams and remote frames.</p>

<b>string type:</b>	<p>Type specifier used to describe parameters in command and table description files.</p> <p><b>Parameters:</b></p> <ul style="list-style-type: none"><li>&lt;type&gt; <b>string_type</b></li><li>&lt;unit&gt; - (not significant)</li><li>&lt;scale&gt; - (not significant)</li><li>&lt;no_of_bytes&gt; 1 to 7 (commands, limited by data length of telegram) or 1 to 5 (tables, limited by table fragment length).</li><li>&lt;byte_addr&gt; unsigned integer value</li><li>&lt;bit_addr&gt; 0 or - (not significant)</li></ul> <p><b>Values:</b> simple ASCII character strings (printable chars &lt; 128)</p> <p><b>Operators:</b> ==, !=</p> <p>Scenario files containing string type specifiers may use expressions containing these operators.</p>
<b>System Comments:</b>	<p>(Protocol File Comment)</p> <p>The following types of protocol file comment lines make it more readable:</p> <ul style="list-style-type: none"><li>• <b>##</b>     comments inserted by the user (typed directly or through scenario command)</li><li>• <b>!!</b>     system comments about monitoring, start/stop, driver errors and external program execution inserted by <b>CANpro</b></li><li>• <b>SI</b>     simulation command executed (optional)</li></ul>
<b>Time stamp:</b>	<p>Absolute time point displayed in Hours:Minutes:seconds:milliseconds. The CAN driver creates relative time values the moment it reads them from or sends them to the CAN bus. Relative time values are converted to absolute time stamps, related to host time if a connection exists with the host computer or to local PC time if a connection does not exist. Absolute time stamps are then passed to <b>CANpro</b> with the telegrams.</p>
<b>uint type:</b>	<p>Type specifier used to describe parameters in command and table description files.</p> <p><b>Parameters:</b></p> <ul style="list-style-type: none"><li>&lt;type&gt; <b>uint_type</b></li><li>&lt;unit&gt; a string expressing a unit, like “[m/s]” or “[kV]”</li><li>&lt;scale&gt; a float number (should have integer value)</li><li>&lt;no_of_bytes&gt; 1 to 4</li><li>&lt;byte_addr&gt; unsigned integer value</li><li>&lt;bit_addr&gt; 0 or - (not significant)</li></ul>

**Values:** positive 32-bit integer values: 1 to 4 bytes multiplied with the scale

**Operators:** ==, !=, >=, <=, >, <, val, &

Scenario files containing uint type specifiers may use expressions containing these operators.

## User

### Defined Type:

Parameter type used to describe parameters in command and table description files.

#### Parameters:

<type> <type\_identifier> of some type defined in the type definition part of the same description file.

<unit> - (not significant)

<scale> - (not significant)

<no\_of\_bytes> 1 to 2

<byte\_addr> unsigned integer value

<bit\_addr> 0 or - (not significant)

**Values:** 8 or 16 bit integer values for which symbolic names are defined in the type definition.

**Operators:** ==, !=, val

Scenario files containing user defined type specifiers may use expressions containing these operators.

## CAN MONITORING

### CAN TELEGRAM MONITORING

CAN Telegram Monitoring monitors and interprets communications on the CAN bus between microcontrollers and host and to and from **SLIOs**. Monitored telegrams are saved in plain ASCII format **protocol files**. A **time stamp** is added to each telegram.

#### NOTE

To achieve acceptable real time behavior, do not run other applications in parallel to **CANpro** while **CANpro** is monitoring.

The **CANpro** CAN Test Tool reads, interprets, displays and records all telegram types (**data**, **CAN command** and **remote frames**) transmitted on CAN bus. They are interpreted using the currently selected machine's description files, displayed on the screen and recorded in a protocol file. Several **types of description files** define the **CAN identifiers**, commands and tables of a **machine**. All description files for the current machine are loaded during **CANpro** initialization. The standard display format consists of one line of interpreted text for each telegram. See **Figure 2**.

<=	001	E 00	00 04 01 02 03 04	ERR MCU F can overrun err	MCU->ALL	11:26:36:292
<=	000	CM	00 00 00 00 00 00	Cancel Mode	MCU->ALL	11:27:05:655
=>	008	CM	00 00 00 00 00 12	Cancel Mode	MCU->ALL	11:27:05:668

**FIGURE 2** Standard Display Format

“=>” and “<=” are the symbols for incoming and outgoing telegrams. The number following “=>” or “<=” is the CAN identifier in hexadecimal format. Telegram contents (if any) are displayed after the identifier:

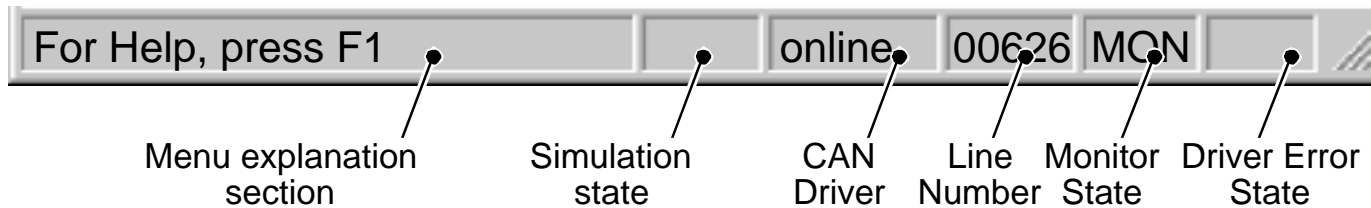
- **Command Name:** The command name is displayed followed by the parameter contents as hex bytes. Then, short text is displayed that explains the command's name.
- **Data Telegrams:** Data contents are displayed as hex bytes. Then, short text is displayed that explains the SLIO state number's interpretation.
- **Remote frames:** Never have contents. The short text is always “Remote Frame”.

Interpreting text for CAN identifiers follow telegram content and the last item is always the time stamp.

Selecting **Telegram Interpretation** from the **Options Menu** allows the user to select command telegrams and tables for detailed interpretation of parameter contents, which are then added to the display.

**Status Bar:**

The status bar is displayed at the bottom of the **CANpro** window.



**FIGURE 3** Status Bar

Status Bar contents from left to right:

- Menu explanation section. Leftmost area of the status bar. Describes actions of menu items as the arrow keys are used to navigate through menus. Also shows messages that describe the actions of toolbar buttons as the mouse passes over them. You do not need to press the left mouse button to view the description. If you happen to click the toolbar button but do not wish to execute the command, release the mouse button when the pointer is off the toolbar button. Activity progress is displayed here for those activities that take longer periods of time to complete, e.g. initialization.
- Simulation state: The name of the currently loaded **scenario file**, or empty.
- CAN driver: “online” if a CAN driver is installed and the hardware has been successfully initialized, or “offline” if no driver is connected or there is no hardware.
- Line number of selected line in the active **protocol file**.
- Monitor state: “MON” if the **monitor** is running, or empty.
- Driver error state: “ERR” if a driver error that may cause loss of telegrams has been detected since the last protocol file has been opened by user action, else empty.

**Description File Types:**

Error Lists: An error list contains error numbers and short texts for one micro controller.

The file name is “ERR\_<err\_cmd\_name>.dsc”

<err\_cmd\_name> ::= E<hex\_controller\_number>

Syntax: <err\_list\_line> ::= <err\_num> <err\_short\_text>

<err\_num>: a decimal or hex number of 1 byte

<err\_short\_text>: [<simple-ascii-character>]1-15

Semantics:	<p>Error Lists are used for short interpretations of individual error numbers contained in the “E” command in telegrams. For each “E” telegram, instead of a command short text, the controller, the error priority and the error number are interpreted.</p> <p><b>CANpro</b> finds the correct error list using the &lt;hex_controller_number&gt; (first parameter byte) of the telegram. Interpretation of the controller name corresponding to the &lt;hex_controller_number&gt; and error priority are taken from the “E.dsc” command description file, which must be written according to the common syntax of description files, where also the term &lt;simple-ascii-character&gt; is defined.</p>
<b>HTML Error Descriptions:</b>	An HTML error description exists that exactly explains the kind of error that has happened for any Error number sent by any scanner controller in an “E” command telegram. Double-clicking the line on which the error is reported in will display a description of the possible causes of the error. Only fatal errors are displayed in red.
<b>CANpro</b>	
<b>Machine Description:</b>	<p>Describes the machine to be tested. Machine description files are the definition of CAN command tables and identifiers used in microcontroller firmware and may include appropriate test scenarios and firmware to load into the flash PROM. CAN parameters describe baud rate, etc. used on the CAN bus.</p>

## CAN TELEGRAM SIMULATION

CAN Telegram Simulation is provided for machine testing. Telegrams normally sent from the host computer to the CT scanner are “simulated”, meaning they are sent using script files called ‘scenarios’. Scenarios are created by the Mx8000 software development engineers and are resident on the CD used to upgrade scanner software. When the CT scanner software is upgraded, the scenario files are copied to the Host computer, after which **CANpro** downloads and encrypts them for you during initialization. Unencrypted scenarios cannot be executed from **CANpro** in Field Service Mode.

### NOTE

To achieve acceptable real time behavior, do not run other applications in parallel to **CANpro** while **CANpro** is monitoring or simulating telegrams.

CAN Monitoring and CAN Simulation may be executed simultaneously. The protocol file then contains telegrams read from the CAN bus and also from simulated telegrams. This is very useful to document executed tests and find the cause for errors. When **CANpro** is used to execute scans, a **Thermal Load Calculator** is used to make sure that the x-ray tube is not damaged.

You can read a description of the scenario file before **loading** it using the “Description”-Button in the Simulation Load dialog. **Execute** the scenario if you are sure you have loaded the correct scenario.

## LOADING AND CHECKING SCENARIO FILES

Syntactic and semantic checking of the scenario file prior to usage is achieved by the menu command **Simulation Load**. Commands and control structures are converted into ready-to-run internal structures when the scenario file is loaded.

### Syntax checking:

Syntax errors in the scenario language generate an error message box containing the following information:

- Cause of the error
- Location of the incorrect syntax

Scenarios with syntax errors cannot be executed. Attempting to load a scenario with syntax errors results in the following:

- loading is stopped
- the affected scenario file is presented in an edit window
- the line containing the token causing the error is highlighted

**Semantics checking:**

**CANpro** displays a warning in a message box if you attempt to load a scenario that contains CAN command names, parameter labels and CAN identifiers not defined for the current machine. Loading is not stopped and the warning is suppressed during simulation.

**SCENARIO FILE EXECUTION****General Requirements for Simulation:**

Make sure that **CANpro** is running exclusively on the PC with no other Windows or DOS applications active and the following conditions are met before starting a simulation scenario:

- The PC is equipped with a CAN card
- The **CAN driver** must be online (look at CAN driver field in **CANpro**'s status bar)

**NOTE**

If you want to start scans with x-ray, please read about the Thermal Load Calculator.

**To achieve acceptable real time behavior, do not run other applications in parallel to CANpro while CANpro is monitoring or simulating telegrams.**

- The **CAN parameters** must be the same that are used on the CAN bus you are evaluating (normal case with nothing changed)

The loaded simulation is started by the menu command **Simulation Start** <sim\_name>. Make sure :

- The **general requirements for simulation** are met before starting.
- The name of the loaded scenario file is displayed on the menu item.

The **simulation running** dialog that contains the Abort Scenario button is displayed. If you press this button, the running simulation scenario is aborted, but the scenario remains loaded. Scenario calls are added to the protocol file if the "Print Scenario Calls into Protocol File" option under **Options, Simulation** is set and the monitor is running.

**CAN Parameters:**

The baud rate used for sending and receiving telegrams is set in the Bus Timing Registers **BTR0** and **BTR1**. For the hexadecimal values corresponding to the different baud rates, see the documentation of your CAN card.

You should change the CAN parameters only if the new parameters harmonize with those used on the CAN bus you are evaluating. This may be the case if no telegrams can be monitored and everything else (CAN card OK, physical connections exist, monitor ON) seems to be all right.



**Simulation Options Dialog Box:****NOTE**

Current simulation options are user-specific and will be saved at the end of **CANpro** execution.

With this dialog box you can specify the following options:

- Checkbox “**Print Scenario Calls into Protocol File**”:

Scenario calls are inserted into the protocol file if the monitor is ON during simulation when this option is checked. This option is useful if you are developing and testing test scenarios.

- Checkbox “**Abort scan and gantry movements when aborting Scenario**”:

**NOTE**

Safety considerations dictate this box be checked at all times. Do not disable this option unless absolutely required.

The test scenario is aborted and the CAN command (**CS**) is sent to the gantry to stop the current scan every time the Abort Scenario button is pressed and this option is checked.

**Manual X-ray Dialog:**

This dialog allows the configuration of the most important **mode table** parameters related to x-ray generation, collimator motion, and gantry rotation. See **Figure 4**.

On the **Parameters** page, you set the parameter values.

- The mode and **cycle tables** consist of two modes in total:
  - a PREMEASUREMENT
  - a ROT MODE or STATIC

On the **Switches** page, you set the parameter values.

- It allows each of the switch bit fields of TF0 to be disabled (force to 0), enabled (set to 1), or not alter (use the defined value generated automatically).

## WARNING

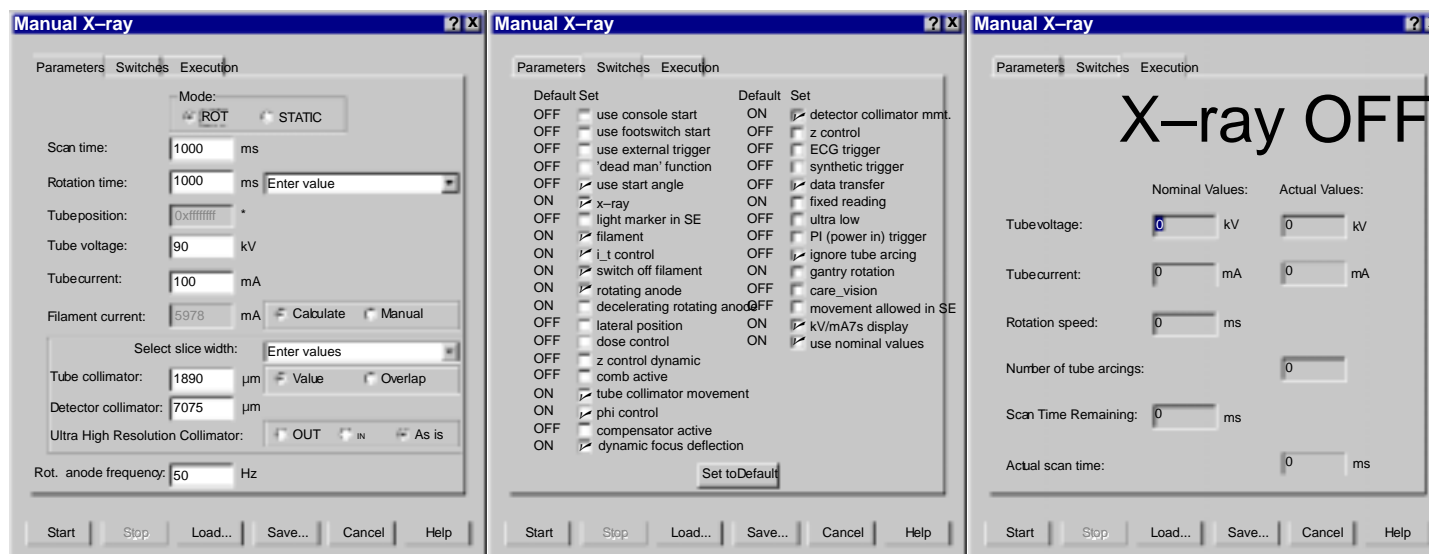
**ALL POSSIBLE COMBINATIONS ARE NOT ALLOWED. IF YOU SET “X-RAY” ON, “ROTATING ANODE” MUST ALSO BE ON. FAILURE TO COMPLY WILL RESULT IN DAMAGE TO THE X-RAY TUBE OR SCANNER IF YOU DO NOT KNOW EXACTLY WHAT YOU ARE DOING.**

**FOR FIELD SERVICE USERS, THIS IS ADAPTED AUTOMATICALLY BY CANPRO.**

Pressing the START button displays the **Execution** page.

- A scan with the previously chosen values is executed.
- You cannot alter the parameters and switches any more.
- Actual values of some parameters are displayed as they are received from the scanner machine.

You have the option to save the settings for a given test under a unique name that may be recalled later while working on other machines. These files are called Manual X-ray files (\*.xray).



**FIGURE 4** Manual X-ray Parameters, Switches and Execution tabs

## “HOW TO”

### **How to evaluate protocol files on a PC without any CAN card:**

A protocol file is a simple (but large) text file. In most cases the easiest way is to print your protocols directly from **CANpro**.

Having the CAN Card or dongle installed on your PC is not required for viewing and printing protocols. **CANpro** will inform you in its initialization phase that it is “offline”. This means that monitoring and simulation cannot be started. However, you can open your files, review them and print the pages or select the lines you want to print.

### **How to perform long-term monitoring during one or more weeks:**

For a long-term monitoring, you need disk space, disk space and disk space.

#### **First, prepare your computer:**

1. We suggest rebooting the computer to reallocate system resources used by other applications but not freed up after the application is closed.



#### **CAUTION**

TO ACHIEVE ACCEPTABLE REAL TIME BEHAVIOR, DO NOT RUN OTHER APPLICATIONS IN PARALLEL WITH CANPRO WHILE CANPRO IS MONITORING, FLASH LOADING OR DURING SIMULATION. FOR THE SAME REASON, YOU SHOULD NOT USE A SCREEN SAVER.

2. Delete any unnecessary files to free as much disk space as possible.

#### **Then, prepare CANpro:**

3. Select or enter a proper machine name for the scanner machine you are connected to. **CANpro** downloads the necessary files for you.
4. Open a protocol file with menu File New Protocol (**CTRL+N**), and start monitoring with Monitor Start. Test if the **CAN parameters** are correct and you receive telegrams from the tested machine.
5. Stop the monitor.
6. Look at the options for telegram interpretation. The selected option for commands and tables should normally be **none**, since explicitly interpreted telegrams create several lines of text instead of one. However, there may be cases when you want to select a few commands or tables to be explicitly interpreted.

7. Look at the options for telegram filtering. You may leave out telegrams with IDs you are absolutely not interested in (by default, SLIO telegrams are left out). You can filter any telegrams out that you want, since the **background protocol** will still store all telegrams.
8. After this, you can start monitoring.
9. Turn off the screen until you come back.

**How to go on with a sequence of auto numbered protocol files:**

**CANpro** generally adds eight zero digits to the protocol file name you selected, and goes on numbering the files as they are full. So if you say File New Protocol (CTRL+N) giving as name “Testcase115a-on-TX17-by-Mary” or “Testcase115a-on-TX17-by-Mary.cpf”, the first protocol file will be named “Testcase115a-on-TX17-by-Mary-00000000.cpf”, the next “Testcase115a-on-TX17-by-Mary- 00000001.cpf”, and so on.

Sometimes, you have closed the current protocol file or you have left **CANpro** for some reason, but afterwards you want to go on numbering with the same file name:

You create a protocol file with menu File New Protocol (**CTRL+N**), giving it the same name as before:

Either without number and extension: “Testcase115a-on-TX17-by-Mary”, or you choose one of the already existing protocol file names with the same naming scheme: “Testcase115a-on-TX17-by-Mary-00000017.cpf”.

Then, **CANpro** notes that there are already some files with the same naming scheme, so it offers a dialog in which you can choose if you want to go on counting or overwrite the numbered files with this name. You choose “go on counting” and get the file name with the next number in the current numbering scheme.

**How to load firmware to the gantry:** See the Flash Load and Read section below.

**How to read firmware from the gantry:** See the Flash Load and Read section below.

## FLASH LOAD AND READ

### NOTE

Do not run other applications in parallel to **CANpro** at the same time you do Flash Loading or Reading.

Load binary files to and read from the flash PROM of the CT scanner machine. This is used for updating the scanner machine's firmware program. Flash Loading and Monitoring can be executed at the same time. The protocol file then contains telegrams read from CAN bus and the flash telegrams sent by **CANpro**.

Flash Loading or Reading is possible in the following scanner machine states:

- STOP
- INIT\_DONE
- HALT
- TABLE\_LOAD

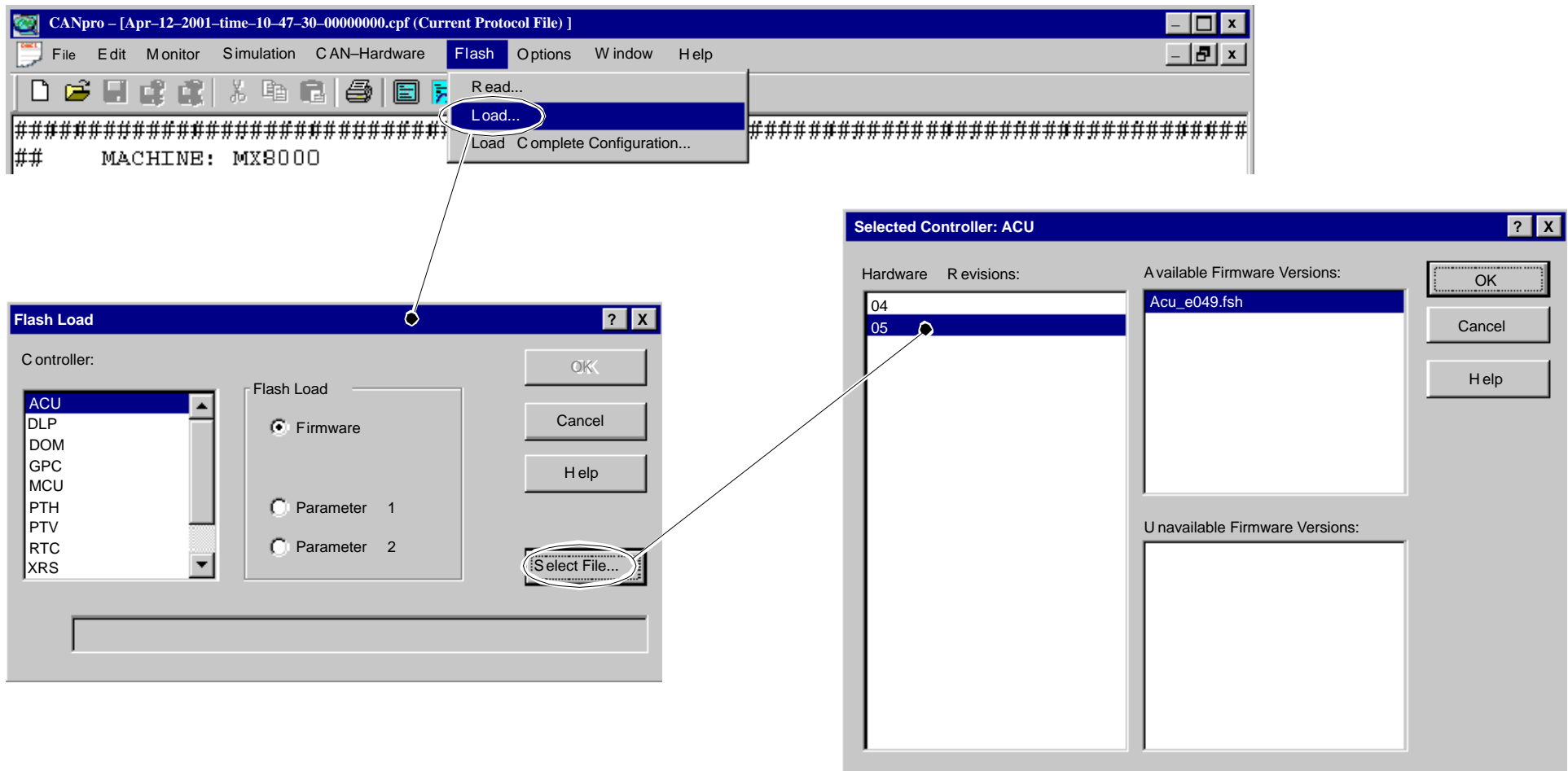
**Load** the controllers' firmware and parameters stored in binary files via CAN bus into the controllers' flash PROM. It is now easy to choose a firmware version matching the hardware revision of the controller.

**Read** the controllers' firmware and parameters from the controllers' flash PROM and store them into a binary file.

### How to load firmware to the gantry:

Flash Loading or Reading is possible in the following scanner machine states:

- STOP (from STANDBY: press STOP button)
- INIT\_DONE (switch machine on, when it is OFF)
- HALT (especially when a firmware has not been loaded completely, machine will get into HALT after trying to INIT it)
- TABLE\_LOAD



**FIGURE 5** Flash Load Firmware and Parameters

In the menu command **Flash-> Load**, **CANpro** uses a file “**firmware\_lookup.cfg**” in the firmware directory of the standard machine description **MX8000** to look up for each hardware component (for example, “ACU” or “GPC”) a list of hardware revisions and matching firmware versions.

If you want to update only one controller, you choose an available firmware version with the **Firmware Configuration Tool**:

- Use the menu command Flash -> Load.
- **CANpro** switches all controllers into Flash mode by sending Flash Start (FS).
- You can specify the file name, the type of file (firmware, parameter block 1 or 2) and the controller. If you load firmware, the Firmware Configuration Tool is used to select a matching firmware file.
- **CANpro** sends Flash Clear(FC) with the selected controller number.
- Then it sends the firmware block by block to the Master, starting with Flash Block (FB) and waiting for Flash Verified (FV) after the block.
- Afterwards, it asks you if it shall go on loading. If you user select “No”, **CANpro** send Flash Done (FD) to all controllers, and then Init Start (IS) to get the machine into an operable state again.
- If any block is not confirmed in the predefined time, **CANpro** asks the user if the block shall be repeated.

After loading a firmware to flash PROM of a controller, the file “**gantry\_hardware\_firmware.cfg**” of this particular scanner machine is automatically being updated by **CANpro** and uploaded to the host of the scanner machine. There is a new menu option Flash -> Load Complete Configuration that allows you to use an existing file “gantry\_hardware\_firmware.cfg” to update all firmware components at once. It can be the one of a different machine, or a standard file stored in any directory.

#### **Flash Load:**

Use this menu command to load firmware and parameters stored in binary files via CAN bus into the controllers' flash PROM. Flash Loading or Reading is possible in the following scanner machine states:

- STOP
- INIT\_DONE
- HALT
- TABLE\_LOAD

The **Flash dialog box** for selecting the file, the controller and the file type will appear.

#### **Flash Dialog Box:**

In this dialog box, you select the controller to flash and the file to flash it with. Files are selected by pressing the Select File button.

The following options are available:

- The **Firmware Configuration Tool**, used to select a firmware matching the controller's hardware revision for **Flash Load**
- The **Read File Dialog** to input a correct file name with path for **Flash Read**.

#### **Firmware Configuration Tool:**

You reach this dialog by menu **Flash Load** from the **Flash dialog box**.

As the **MX8000** matures there will be a need to insure that hardware modules that require downloadable firmware to be loaded with the correct firmware versions. All hardware modules may have different revisions. Each revision of a hardware module may in turn require a new and unique version of firmware to operate correctly and safely. As such, a hardware module of a given revision must be loaded with firmware of the correct version.

**CANpro** uses a file "firmware\_lookup.cfg" that it finds always in the firmware directory of the standard machine description MX8000 to look up and offer the possible choices.

In the Flash Dialog Box you have already chosen the hardware component (for example, "ACU" or "GPC"). Then click **Select File**. For this component, a list of hardware revisions is presented here. After choosing a hardware revision, a list of matching firmware versions is given, and you choose one of them. This firmware will be loaded to the controller, then.

You can choose only from the firmware versions in the upper right list box. These are the files available in the **MX8000** firmware directory.

If there are any firmware versions listed below "Unavailable Firmware Versions", these files need to be installed to your PC using the **Firmware Setup Tool**, before you can load them.

After loading, the file "**gantry\_hardware\_firmware.cfg**" of this particular scanner machine is being updated and uploaded to the host of the scanner machine. In this way, the current hardware/firmware configuration is always stored completely on the host - provided that the **CANpro**-host connection has been established.

#### **Load Complete Configuration (Flash Menu):**

This menu option allows you to use an existing file "**gantry\_hardware\_firmware.cfg**" to update all firmware components at once. In this way, you can copy a hardware/firmware configuration from one machine to the other:

- A dialog is opened where you select which "gantry\_hardware\_firmware.cfg" file is used as input.
- You can select the "gantry\_hardware\_firmware.cfg" file of a different machine with the same hardware configuration, or a standard file in a different directory.



**CANpro** reads that file and checks if all firmware files needed are found in the corresponding %machines%/MX8000/firmware/<controller> directories.

After **CANpro** has successfully loaded the firmware files to the flash PROM of each controller, the new “gantry\_hardware\_firmware.cfg” file is stored in the machine’s firmware directory and uploaded to the host of the scanner machine.

### **How to read firmware from the gantry:**

Flash Loading or Reading is possible in the following scanner machine states:

- STOP (from STANDBY: press STOP button)
- INIT\_DONE (switch machine on, when it is OFF)
- HALT (especially when a firmware has not been loaded completely, machine will get into HALT after trying to INIT it)
- TABLE\_LOAD

Use the menu command Flash -> Read.

- **CANpro** switches all controllers into Flash mode by sending Flash Start.
- You can specify the file name, the type of file (firmware, parameter block 1 or 2), the number of blocks(1 to 52, depending on firmware length) and the controller. If you know the length of the firmware, specify the block number. If you don’t, leave it the default value which is the maximum length.
- **CANpro** sends Flash Read with the selected controller number and the first block number.
- It waits for the whole block to be received and writes it into the file.
- After receiving all blocks, it asks you if it shall go on reading.
- If you select “No”, **CANpro** send Flash Done (FD) to all controllers, and then Init Start (IS) to get the machine into an operable state again.
- If any block is not sent in the predefined time, or a fragment is damaged, or a fragment number is missing, **CANpro** asks you if the block shall be repeated.

**Flash Read:**

Use this menu command to read a firmware file or parameter block from flash PROM and store it into a binary file.

Flash Loading or Reading is possible in the following scanner machine states:

- STOP
- INIT\_DONE
- HALT
- TABLE\_LOAD

The **Flash dialog box** for specifying the name of the file and selecting the controller and the file type will appear.

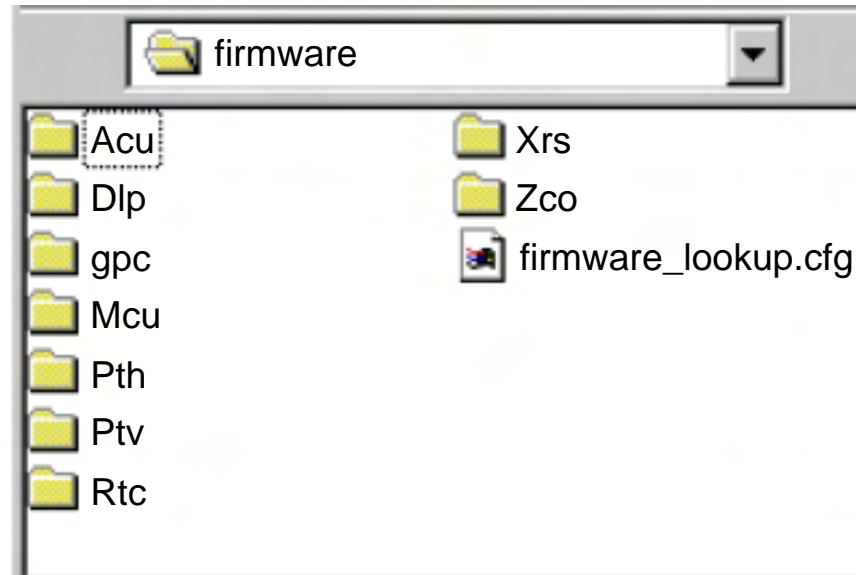
**Read File Dialog Box for Flash Read:**

The following options allow you to specify under which name the firmware file read from the controller should be stored:

- Select the drive and directory.
- Type or select the filename you want to use.
- You can save flash firmware files with any kind of extension. Standard flash file extension is “.fsh”.

**How to update CANpro with firmware versions:**

Periodically you will get a firmware setup floppy, CD-ROM or any other medium for updating the firmware files and the firmware lookup configuration file (**firmware\_lookup.cfg**) on your **CANpro** PC. Execute the setup program from the medium on which you received it. New firmware files and an updated “**firmware\_lookup.cfg**” file are copied to the correct path where **CANpro** expects to find them - the firmware directory of the standard machine description MX8000. This helps you to keep the **Firmware Configuration Tool** for menu command **Flash-> Load** up to date. Firmware setup is prepared as follows:

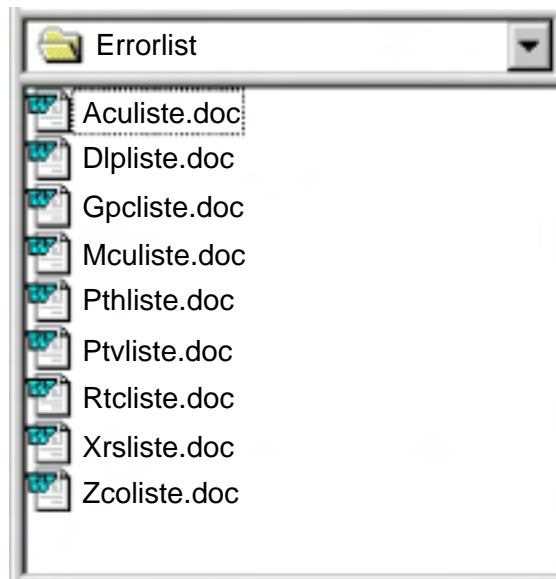


**FIGURE 6** Firmware Setup

1. Copy the file **firmwaresetup.exe** to the root directory of the hard disk. You find it on the **CANpro** installation CD-ROM.
2. Run **firmwaresetup.exe**.
3. There is a directory called **firmware/** (**Figure 6**) that contains the updated “**firmware\_lookup.cfg**” file, and sub directories with firmware files for each controller.

**How to update CANpro with additional error documents:**

The firmware setup floppy/CD-ROM will also contain error documents that provide additional information about system errors. Execute the setup program **errorlistsetup.exe** from the medium on which you received it. It will copy the new error documents to the correct path: the **errorlist** directory of the standard machine description **MX8000**. You can access them there via a symbol on the desktop, as well as directly from your Microsoft Word application.



**FIGURE 7** Errorlist Setup

The error document setup is prepared as follows:

1. Copy the file **errorlistsetup.exe** to the root directory of the hard disk. You find it on the **CANpro** installation CD-ROM.
2. Run **errorlistsetup.exe**.
3. There is a directory **errorlist** ([Figure 7](#)) that contains the updated error document files for each controller:

## USER INTERFACE COMMANDS

### MENUS

#### File Menu

##### New

You can create new documents with the New Protocol command.

##### New Protocol

Use this command to create a new protocol file in **CANpro**. The Create Protocol dialog box appears and a default name for the protocol file is proposed (a combination of current date and time). You are free to enter a different file name.

You can open an existing protocol file with the Open command. Keyboard Shortcut: **CTRL+N**

##### Create Protocol Dialog Box

This dialog is used by **CANpro** to create a new protocol file. The following options allow you to specify which file to select:

##### File Name

- Type or select the name of the file you want to create. A default name for the protocol file is proposed that is a combination of current date and time. You are free to enter a different file name.
- A hyphen and a counter containing 8 digits with value 0 are automatically added to each file name. The file name itself without the counter and extension can contain up to 45 characters. If you enter a hyphen followed by an 8-digit number at the end of the file name, **CANpro** will consider it as a counter and will not add another one.
- Extension “.cpf” will automatically be added if you don’t enter it itself. As Windows (32bit) allows periods in file names, any different extension you enter is considered as a part of the file name, so “.cpf” will be added after it.
- If the entire file name (including counter and extension) already exists, **CANpro** will offer a dialog where you can choose to go on counting or overwrite the existing numbered files (**Overwrite File Dialog**).

##### List Files of Type

Select the type of file you want to see. The drive where you create the current **protocol file** must be a local hard disk drive.

### Overwrite File Dialog

If you try to create a file that already exists, **CANpro** asks if you want to overwrite the file(s). If you select a protocol file with an existing name, **CANpro** checks (beginning with the current number) up to which number files with this name exist. If you enter a file name without the number, **CANpro** starts searching with 0. It offers you radio buttons with the following alternatives:

- Overwrite all files: Starts again with the number you have entered or with 0 if you haven't entered any.
- Go on numbering: Uses the first number that is still free to create the new numbered file name.

### Open

Use this command to open an existing document in a new window. The File Open dialog box will appear. You can:

- Open multiple documents at once
- Use the Window menu to switch among the multiple open documents. See Window 1, 2, ... command.
- Create new documents with the New Protocol

Toolbar Shortcut:



Keyboard Shortcut:

**CTRL+O**

### Close

#### **NOTE**

Protocol files are saved automatically. You must first stop monitoring before closing the current protocol file.

Use this command to close all windows containing the active document. **CANpro** suggests saving changes before closing. Closing a document without saving loses all changes made since the last save. Before closing an untitled document, **CANpro** displays the Save As dialog box and suggests that you name and save the document.

Mouse Shortcut:



Close the document by clicking the Close Button [X], at right top of the document's window.

### Save

Use this command to save the active document to its current name and directory. When you save a document for the first time, **CANpro** displays the Save As dialog box so you can name your document. If you want to change the name and directory of an existing document before you save it, choose the Save As command. Note: **CANpro** protocol files are saved automatically.

Toolbar Shortcut:

Keyboard Shortcut: **CTRL+S**

### Save As

Use this command to save and name the active document. **CANpro** displays the Save As dialog box so you can name your document. To save a document with its existing name and directory, use the Save command.

File Save As Dialog Box: The following option allows you to specify the name and location of the file you're about to save:

- **File Name:** Type a new filename to save a document with a different name. **CANpro** adds the extension you specify in the Save File As Type box. If it is a **test scenario file**, its file name without extension ".tsc" can contain up to 45 characters.

### Print

Use this command to print a document. This command presents a Print dialog box, where you may specify the range of pages to be printed, the number of copies, the destination printer, and other printer setup options.

Print dialog box: The following options allow you to specify the name and location of the file you're about to save:

- **Printer:** This is the active printer and printer connection. You can choose a different printer from the list.
- **Properties:** Displays a printer specific dialog box, where you can change some options of your printer.
- **Print Range:** Specify the pages you want to print:
  - All** Prints the entire document.
  - Selection** Prints the currently selected text.
  - Pages** Prints the range of pages you specify in the "From" and "To" boxes.
- **Copies:** Specify the number of copies you want to print for the above page range.

If you want to change the headers and footers, choose **Page Setup**.

### Print Preview

Use this command to display the active document as it would appear when printed. When you choose this command, the main window will be replaced with a print preview window in which one or two pages will be displayed in their printed format. The print preview toolbar offers you options to view either one or two pages at a time; move back and forth through the document; zoom in and out of pages; and initiate a print job.

- Print Preview Toolbar:      The print preview toolbar offers you the following options:
- Print:            Bring up the print dialog box, to start a print job.
  - Next Page:      Preview the next printed page.
  - Prev Page:      Preview the previous printed page.
  - One Page:      Preview one printed page at a time.
  - Two Page:      Preview two printed pages at a time.
  - Zoom In:        Take a closer look at the printed page.
  - Zoom Out:      Take a larger look at the printed page.
  - Close:           Return from print preview to the editing window.

### Page Setup

Use this command to define the setup of a printed page. A Page Setup dialog box appears, to define header and footer.

- Print Preview Toolbar:      You can define the contents of the header and footer printed on each page. Both of them consist of a text that you specify in the edit fields. The text can contain the following variables:
- &f      current file name
  - &p      current page number.
  - &t      time (when you print the document)
  - &m      modified time (last time the document was modified)

### Print Setup

Use this command to select a printer and a printer connection. This command presents a Print Setup dialog box, where you specify the printer and its connection.



Print Setup Dialog Box: The following options allow you to select the destination printer and its connection.



- **Printer:** Select the printer you want to use. Choose the Default Printer or choose the Specific Printer option and select one of the currently installed printers shown in the box. You install printers and configure ports using the Windows Control Panel.
- **Orientation:** Choose Portrait or Landscape.
- **Paper Size:** Select the size of paper that the document is to be printed on.
- **Paper Source:** Some printers offer multiple trays for different paper sources. Specify the tray here.
- **Options:** Displays a dialog box where you can make additional choices about printing, specific to the type of printer you have selected.
- **Network...:** Choose this button to connect to a network location, assigning it a new drive letter.

### 1, 2, 3, 4, ... command

Use the numbers and file names listed at the bottom of the File menu to open one of the latest documents you closed. Choose the number that corresponds with the document you want to open. **Note:** with the number commands, you always open a document for reading only. If you want to open it reading and writing, use the **Open** command!

### Exit

Use this command to end your **CANpro** session. You can also use the Close command on the application Control menu. **CANpro** prompts you to save documents with unsaved changes.

Mouse shortcut:		or:		Keyboard shortcut:	<b>ALT+F4</b>
	Double-click the <b>Application Icon</b> Main Window, top left		Single-click the <b>Close Button [X]</b> Main Window, top right		

### **Edit Menu**

### Undo

Edit windows only. Use this command to reverse the last editing action, if possible.

Keyboard shortcut: **CTRL+Z** or **ALT-BACKSPACE**

## Cut

Edit windows only. Use this command to remove the currently selected data from the document and put it on the clipboard. This command is unavailable if there is no data currently selected. Cutting data to the clipboard replaces the contents previously stored there.

Toolbar shortcut:  Keyboard shortcut: **CTRL+X**

## Copy

Edit windows only. Use this command to copy selected data onto the clipboard. This command is unavailable if there is no data currently selected. Copying data to the clipboard replaces the contents previously stored there.

Toolbar shortcut:  Keyboard shortcut: **CTRL+C**

## Paste

Use this command to insert a copy of the clipboard contents at the insertion point. This command is unavailable if the clipboard is empty.

Toolbar shortcut:  Keyboard shortcut: **CTRL+V**

## Find

Use this command to search for specific text. When the active window contains an editable file (description file or test scenario file), this command presents the standard Find dialog box, where you specify the text you want to find. When the active window contains a **CANpro** protocol file, this command presents the Search For Telegram Dialog Box where you specify the text you want to find in the protocol file.

Keyboard shortcut: **ALT+F3**

Find Dialog Box: The dialog box lets you specify which text to find and which rules are valid for search:

- Search: Type text in the edit field that you want to find.
- Case Sensitive: If this option is turned ON, only text that is written exactly as specified matches. Otherwise uppercase/lowercase writing is not relevant.
- Find Buttons: If Find Next Backwards is selected, the search will be done from current position towards beginning of the document. If Find Next Forward is selected, the search will be done from current position towards end of the document.

**NOTE**

The Find dialog box remains displayed until you press the Cancel button. So you can search the next occurrence of the specified string without specifying it again.

- Cancel: Finishes the find activity.
- Telegrams only: Allows you to choose which field to search within the telegram when selected.

#### Search for Telegrams Dialog Box

Specific search function for monitor protocol files that helps find a text string in one or more defined parts of an interpreted CAN telegram. One or more sections of the telegram interpretation line are selectable. To search comments in protocol files, uncheck the box "Telegrams only".

=>	001 E	d0 00 03 1a 2b 3c 4d	ERR!!	F !! No errlist	MCU->ALL	14:23:30:279
=>	096 PH	f2 72 00 c8 09	Position Horizontal	PTH-MCU		14:23:30:281
	Command					
	Identifier	Parameters	Description	From/To		Time Stamp
Direction						

**FIGURE 8** Telegrams Only Search Fields

#### Replace command

Edit windows only. Use this command to substitute a specific text in the document by a different one. This command presents a Replace dialog box, where you specify which text you want to replace by which substitution.

Replace Dialog Box: The dialog box lets you specify which text to replace by a different one and which rules are valid for substitution:

- Find: Edit field for type in the text you want to replace by a different one.
- Replace with: Edit field for type in the text you want to set
- Case Sensitive: If this option is turned ON, only text that is written exactly as specified matches. Otherwise uppercase/lowercase writing is not relevant.
- Find Next: Finds the next occurrence of the searched text without replacing it.
- Replace: Replaces the currently selected text by the substitution text
- Replace All: Replaces all occurrences of the searched text by the specified substitution text.

**Monitor Menu:**Start

Use this menu command to start **CAN monitoring**. You can not start the monitor unless there is an open **protocol file** the telegrams can be stored in. If no protocol file is currently open, the **Create Protocol dialog box** will be displayed and you are asked to create a new protocol file first. If you create a new protocol file, the monitor will start and append arriving CAN telegrams to this file that is displayed in the protocol window. If you leave the Create Protocol dialog box with the Cancel button, the monitor will not start. With the menu function **Options Telegram Interpretation** you can dynamically select which **CAN command** and table telegrams shall be interpreted in detail, so that you can observe the parameter contents. You can call this option before and during monitoring.

Toolbar shortcut:

Keyboard shortcut: **F2**Stop

Use this command to stop **CAN monitoring**. The **protocol file** remains open. No CAN telegrams will be appended to the protocol file any more. When monitoring is OFF, **CANpro** still fetches the telegrams from the CAN driver and throws them away.

Toolbar shortcut:

Keyboard shortcut: **F3**Monitor comment

Use this command to insert a comment to the current protocol file. The Monitor Comment dialog box will appear for editing the comment text. As soon as you press the OK button, the comment text will be appended to the protocol file. If you have some standard texts that you want to append more frequently, you may prefer using **predefined comments**.

Monitor Comment Dialog Box:

Dialog box for editing a comment text to be appended to the current protocol file. You can use up to 90 Characters. The text will be introduced by “##” at the beginning of line in the protocol file.

Keyboard shortcut: **F7**Interpret Telegram

Use this command to show the CAN command selected in a protocol file in detailed interpretation in a separate window. The **CANpro Telegram Interpretation Window** will appear. It remains displayed until you close it by clicking the OK-Button.

Keyboard shortcut: **F8**      Mouse shortcut: Double-click the line to be interpreted.**CANpro Telegram Interpretation Window**

Separate window in which the detailed interpretation of the CAN command selected in a **CANpro** protocol file is displayed. **OK** closes the window.

### Search For Telegram

Use this command to search for a telegram in the current protocol file that contains a specific text in one or more fields of the interpreted telegram; for example, in the identifier, the parameters, the short text or the time stamp. The **Search For Telegram Dialog Box** will appear. To search also comments and error texts in a protocol file, uncheck the check box “**Telegrams only**”.

Keyboard shortcut: **F9**

### Gantry Status

Use this menu option to open the Gantry Status Window, where you get information about the current gantry status.

### **Simulation Menu:**

#### Simulation Load

Use this menu command to load a **scenario file**. The Load Scenario dialog box for specifying the scenario name will appear. The scenario file is examined for syntax errors, and if any are found, will be opened in an edit window. Re-edit it and load it again! If the scenario file contains **identifiers** or **CAN commands** not defined for the current **machine**, only a warning will be given and the scenario file is loaded. When the scenario is loaded, the scenario filename is displayed in the status bar.

Load Scenario Dialog Box:	The following options allow you to specify which file to open:
File Name	Type or select in the file list the filename you want to open. This is an explorer style dialog box: you can see details of the files by just pressing the details button above the file list.
List Files of Type	You can open scenario files with extension “.tsc”.

You can get more information about the currently selected scenario name in the file list by pressing the Description button!

#### Simulation Load With Correction

Use this menu command to load a scenario file with filament current correction. The Load Scenario dialog box for specifying the name of the scenario file will appear. When the selected scenario is loaded, the **mode table** fragments that contain the “filament current” parameter are replaced by different values, that have been looked up in a MCU Filament file downloaded from the host. This file contains information that is changed according to the tube aging process.

#### Simulation Start

Use this menu command to start the loaded scenario file. The file will be **executed**. You must load a scenario before you can run it.

Keyboard shortcut: **F4**

### Simulation Running Dialog:

This dialog is opened when you run a simulation scenario and its purpose is to remind you that a scenario is active.

When “Abort scan and gantry movements when aborting Scenario” under **Options, Simulation** is set and the Abort Scenario button is pressed, the CS command is automatically sent to the gantry and the simulation stops running. Shortcut Key: **ESC**

### Manual X-ray

Use this menu option to interactively configure a subset of scan parameters and switches to allow basic x-ray production. You can alter a set of parameters and switches. The **Manual X-ray Dialog** is being displayed.

### Mode Table Switch Settings Dialog

This feature allows the user of **CANpro** to disable (force to 0), enable (set to 1), or not alter (use the defined value found in the scenario) given switches in **mode tables** TF0 and TF2 when a scenario is run. The values you choose here are used for all scenarios that are started after setting them, including the currently loaded scenario.



#### **CAUTION**

IF YOU SET “X-RAY” ON, ALSO “ROTATING ANODE” MUST BE ON. OTHERWISE, THE TUBE WILL BE DAMAGED. FOR FIELD SERVICE USERS, THIS IS ADAPTED AUTOMATICALLY BY CANPRO.



#### **WARNING**

**NOT ALL POSSIBLE COMBINATIONS ARE ALLOWED. YOU CAN DAMAGE THE SCANNER MACHINE IF YOU DO NOT KNOW EXACTLY WHAT YOU ARE DOING.**

### 1, 2, 3, 4 ... command

Use the numbers and file names listed at the bottom of the **Simulation** menu to load and run one of the latest scenarios you loaded. Choose the number that corresponds with the scenario file you want to run.

## **CAN-Hardware Menu:**

### Reset Card

Use this command to force a physical RESET of the currently used CAN card. The use of this command during monitoring may cause the loss of incoming and outgoing telegrams that are stored in the **CAN driver's** internal ringbuffer. **CANpro** therefore appends a **system comment** to the current **protocol file**, that a hardware reset has taken place.

## **Flash Menu:**

**Flash Read**                      See **Flash Load and Read** section, page 22

**Flash Load**                    See Flash Load and Read section, page 22

**Options Menu:**Change Machine

Use this menu command to select a different **machine** (must stop monitoring). The Select Machine dialog box will appear. If you select a new machine there, **CANpro** will unload all **description files**. **CANpro** will try to synchronize again with the host, and load the description files provided with the selected machine. The **CAN driver** configuration will be adapted using the **CAN parameters** of the selected machine. If you cancel the dialog immediately, you will get back to the previously selected machine. If you have already tried to load one that failed, the easiest thing is to select the previously loaded machine again.

Select Machine Dialog Box: You can either:

- enter a new machine name and synchronize the machine description with the host

**NOTE**

In the following cases, you can not execute test scenarios with x-ray

- enter a new machine name and get the machine description from an external source.
- select an existing machine name (including the default machine “MX8000” ) and make no synchronization with host.

If you select an existing machine and try to synchronize files with host, you will be allowed to do scans with x-ray only if all files are exactly the same in the machine directory and on the host.

Remove Machine**NOTE**

- You cannot remove the currently selected machine.
- You cannot remove the default machine “MX8000”.

Use this command to remove any machine from the list of selectable machine descriptions. The Remove Machine Dialog Box is displayed.

**CAUTION**

REMOVE A MACHINE ONLY IF YOU WILL NOT NEED IT ANY MORE, NEITHER THE CONFIGURATION FILES AND TEST SCENARIOS, NOR THE TEST RESULTS.



### Remove Machine Dialog Box:

The dialog box shows a list of all **machines** that have been already defined with **CANpro** on your PC. You can **remove a machine** by clicking a machine name in the list.

### Telegram Interpretation

Use this menu command to select which **CAN commands** and tables the **monitor** should interpret in the long form, displaying also parameter values. The Telegram Interpretation Options dialog box appears.

### Telegram Interpretation Dialog Box

The dialog box shows a list of all available CAN commands and a list of all available tables. The selected CAN commands and tables are interpreted by the monitor in the following way in the **protocol file**:

One or several lines follow the interpreted telegram line, one for each parameter that is described in the description file. It contains the parameter's name (label), and its value. Depending on the parameter type, it is scaled with a scale factor and a unit is displayed in case of integer or float values, or a textual interpretation of the value is given in case of user-defined types.

If a table is selected, the information for each parameter is given in the same way as for command telegram contents. The only difference is that only a fragment of the table is interpreted, since a table is transmitted in several telegrams. The deselected CAN commands and tables are interpreted in the short form.

You can select / deselect commands or tables by clicking on the entries of the lists. The entries toggle between the states selected and deselected. However, if you select a CAN command that has no parameters, or its **description file** has not been loaded, its interpretation does not change.

For quick selection you can:

- deselect all commands/tables by the option **none**
- select all commands/tables by the option **all**

Remark: You can also change these settings during monitoring!

### Telegram Filtering

Use this menu command to open a dialog where you can decide which **CAN identifiers** will be contained and which will be left out in the (foreground, visible) **protocol file**. However, all kinds of telegrams will be contained in the **background protocol**. The information about which IDs are currently filtered out is added to the protocol file on file start and any change of the option.

### HTML Error Descriptions

Use this menu command to open a file dialog where you can select all **HTML Error description files** of the current machine for viewing. The files are grouped in sub directories by the controller name. There is a main list, “errors.html”, that allows you the access to the controller specific lists, and to the individual files. You can obtain the correct file directly for any “E” telegram that has been monitored by double-clicking the line of this telegram in the protocol file.

### Monitoring

Use this menu command to set the options the **monitor** uses for **protocol file** creating, naming and numbering. The Monitoring Options dialog box appears.

#### Monitoring Options Dialog Box:

With this dialog box you define the options for **protocol file** creating, naming and numbering.

Check box **Start Monitor on CANpro Start**: If checked, the **monitor** will automatically be started at next **CANpro** start. The user will be asked to enter a protocol file name.

Option **Protocol File Name Created from Scenario Name**: When a **scenario file** is loaded, the protocol file is created automatically with the same name as the scenario file, some digits for counting and the extension “.cpf”, and the monitor is started.

Option **Protocol File Name Given by User**: The user uses the **File New Protocol** command to create a new protocol file and types in the name or selects an existing name.

Button **Default Path to Protocol Files**: Specifies the path offered by default for the File New Protocol, **File Open** and **Save As** commands for protocol files. This path is also changed if you create a protocol file with a different path using the File New Protocol command. The current monitoring options are user specific and will be saved at the end of **CANpro** execution.

### Simulation

Use this menu command to set the options for **simulation**. The **Simulation Options dialog box** will appear.

### Predefine Comments

Use this command to define up to 10 monitor comments, which can be appended to the end the current monitor protocol file by pressing the hotkeys: Ctrl-0 ... Ctrl-9. The Predefine Monitor Comments dialog box will appear. The defined monitor comments are user specific and they are automatically stored on program termination.

### Predefine Monitor Comments Dialog Box

In this dialog box you can define up to 10 monitor comments. For each comment you can use up to 90 Characters. You can insert them into the current protocol file by pressing **Ctrl-<number>**. The text will be introduced by “##” at the beginning of line in the protocol file.

This option may be useful to all users, in case you observe something interesting sporadically, and you do not want to or cannot write a scenario for marking the place where it occurs. You can also use it for observations you make of the scanner machine itself, as: “table is moving in” or “gantry movement did not stop”.

### Internal Log

Use this menu command to have a look at or change the settings for the **CANpro** internal log file. Purpose: this is an internal function that helps us testing **CANpro**. You do not need to use it normally, only if you are asked for by **CANpro** developers.

### Font

Use this menu command to change the font used by **CANpro**. The Font dialog box will appear.

#### **NOTE**

The selected font is used for **all CANpro** windows, as well as for printing.

### Font Dialog Box

You can specify the font **CANpro** shall use by selecting the following options given in lists:

- Font Name Only fixed fonts are offered. The readability of the **protocol file** benefits from alignment of telegram contents.
- Font Attributes Choose between Normal, Italic, Bold and Bold Italic.
- Font Size Select a size in the range from the smallest to the largest offered value.

Font settings are user specific. They will be saved at the end of **CANpro** execution.

### Tab Stops

#### **NOTE**

The selected tab stop is used for **all** editable **CANpro** windows, as well as for printing.

Use this menu command to change the tab stop value used by **CANpro**. The Tabulator dialog box will appear.

### Tabulator Dialog Box

In this dialog you can change the tab stop value generally used by **CANpro**. In the edit field you can specify the width (measured in character positions) between each two tabulator stop positions. The current tab stop value is user specific. It will be saved at the end of **CANpro** execution.

### Save

Use this menu command to save the currently set options immediately in the registry. The options are always saved at the normal end of the program.

### **Window Menu:**

#### New Window

Use this command to open a new window with the same contents as the active window. You can open multiple document windows to display different parts or views of a document at the same time. If you change the contents in one window, all other windows containing the same document reflect those changes. When you open a new window, it becomes the active window and is displayed on top of all other open windows.

#### Cascade

Use this command to arrange multiple opened windows in an overlapped fashion.

#### Tile

Use this command to arrange multiple opened windows in a non-overlapped fashion.

#### Arrange Icons

Use this command to arrange the icons for minimized windows at the bottom of the main window. If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

#### 1, 2, 3, 4, ... command

**CANpro** displays a list of currently open document windows at the bottom of the Window menu. A check mark appears in front of the document name of the active window. Choose a document from this list to make its window active.

## Help Menu:

### Overview and Index

Use this command to display the opening screen of Help. You can either use the **Contents** page to look for a topic or you can use the **Index** page to find topics containing the keyword or you can use the **Search** page to find all topics which texts contain the searched word.

### Using Help

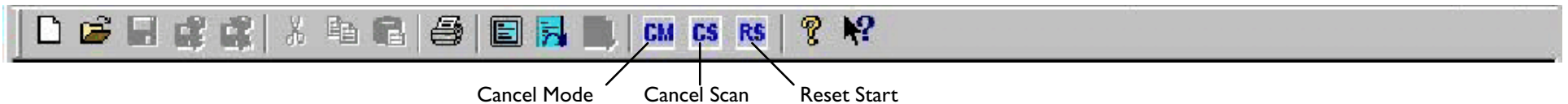
Use this command for instructions about using Help.

### About

Use this command to display the copyright notice and version number of your copy of **CANpro**. You will also find here useful information about the CAN card, the driver version, the security dongle, as well as general information about available memory and disk space (on the hard disk your protocol files are being written to).

## Shortcut Toolbar

Three buttons are provided on the toolbar to send the following telegrams: Cancel Mode (**CM**), Cancel Scan (**CS**) and Reset Start (**RS**)



## TROUBLESHOOTING

### ERRORS THAT MAY OCCUR DURING CANPRO INITIALIZATION

#### Host Connection Errors (Errors During Initialization)

- If the **CANpro** entries in the Registry cannot be found at all, this is a fatal error.
- **CANpro** tries to reconstruct keys and values in case of wrong or improbable Registry entries, which can happen if the Registry is edited directly. Do not directly edit the registry.

In many cases it is best to install **CANpro** freshly. Follow the instructions in the **CANpro** installation manual

#### The CAN Card or Driver (Errors During Initialization)

If an error happens during the initialization of the **CAN card and driver** or there is no driver installed, **CANpro** will be in the “offline” state. This means, that no **CANpro** functions, neither monitoring, simulation, nor flash loading are possible. However, files may be opened, edited and printed. Protocol files can be looked at and telegram lines may be double clicked for further interpretation.

- If the PEAK CAN driver is found, but the hardware has been removed (e.g., the **PEAK CAN Dongle** has been removed from the parallel interface), you will find the state “driver”. You can do everything mentioned above, and additionally you can execute the test scenarios (Simulation, Monitoring) to find out if they work well.
- If you expected to have a hardware installed and you want to monitor or execute tests, you may have to re-install the hardware depending on the actual error message.
- If the PEAK CAN Dongle has been removed and you want to use it again, it may be sufficient to terminate Windows, shut off the computer, connect the PEAK CAN Dongle to the parallel port and to the PS/2 (or DIN) port and restart Windows.

Clicking the symbol “CAN-Hardware” in the system control panel will display a dialog box containing all installed hardware with associated stored values. If the Peak Dongle-Can EPP driver is not present, select it from the hardware list, enter the used parallel port's start address and interrupt (in most cases 378h and 7 for LPT1) and add it to the hardware list.

#### The Machine Description Files (Errors During Initialization)

Normally, the **description files** contained in a **machine description** have been developed and tested before distributing them, so no syntax errors are expected. **If you are a normal developer or service user, do not edit the description files yourself.** If you have edited them by accident:

- Try to use the default machine “**MX8000**” if you are downloading from host or from an external source.
- Reinstall the default machine description “**MX8000**” if that is what you are using. Follow the instructions in the **CANpro installation manual**, using the **CANpro** setup program.

However, if you are the person who writes the description files for a new project, you may get a message that there is a syntax error, describing the exact location with file, line and token where the error was found.

Normally, the effect of this is that this particular file is not loaded; hence this CAN command, table or error list cannot be interpreted. The CAN command list and the identifier list are two exceptions to this rule because neither interpretation of telegrams nor scenario semantics checking is possible for these files. Therefore, these two files cause a fatal error if they contain syntax errors.

The following are used to avoid damages to the x-ray tube:

- **Thermal Load Calculator**
- TAB\_Tf0.dsc
- Other particular table and command description files (some can cause a fatal error in machine loading, since these files need to be present and contain the exact parameter names and types that are expected there, to be able to evaluate the sent and received telegrams).

See How to define a new machine? for more information on writing a new machine description and correcting errors in description files. You can select an existing machine or the default "MX8000" description if you are not able to download the files. If you do not download the needed files from the scanner machine's host, then you are not allowed to use x-ray with this machine. This is a safety precaution to protect the machine from damages caused by mismatching files.

### **MCU Filament File (Errors During Initialization)**

**CANpro** tries to use the default MCU filament file if the MCU filament file has not been found in the **CANpro** directory on the host. **MCU filament current correction** is not possible if this file is also not found. Nevertheless, the machine can be loaded; only the menu option Simulation/Load with filament correction will be disabled.

### **Lack of Main Memory (Errors During Initialization)**

If **CANpro** reports lack of main memory during initialization, you may have **forgot closing other applications** before starting **CANpro**. Remember that **CANpro** needs a good quantity of extra memory so the system does not get into rapid page swapping, what would cause a fatal degradation of execution speed.

Close all other Windows and MS-DOS applications. If the problem still remains, some application has not properly freed all its global memory. Try starting Windows again.

Before doing this, check the size limits of the **paging file**: we recommend at least 125 MB as minimum paging file size, especially when the PC has got only 64 MB RAM (Not selectable for Windows98).

If it is not possible to solve this problem, some memory chips may be damaged.

**Host Connection Errors (Errors During Initialization)**

At **CANpro** start, it attempts to make two kinds of connections to the host:

- FTP files download
- socket connection for logging of **CANpro** activity on the host, time synchronization, as well as for **thermal load calculator** usage

**Error message when exiting CANpro or changing the machine while a scan is running**

If a scan is running that:

- has been originated by **CANpro**
- **CANpro** has sent **mode table** and **cycle table** information to the gantry
- the scan is started by the start command (“SE”)

**CANpro** has stored information about the scan(s) being executed in order to update the **Thermal Load Calculator** with telegrams returned by the gantry for each scan. This is the way the TLC can always calculate current tube temperature and avoid tube damage. If you stop execution of **CANpro** during scans while they are being executed, there are still updating telegrams missing. Therefore, you get an error message. You can choose either:

- Go on changing the machine or executing **CANpro** - then cancel messages are being sent to the gantry to stop all running scans.
- Wait until the current scan has finished and the TLC is properly updated.

**CANpro Cannot Send or Receive Telegrams**

You start **CANpro**, everything seems to be okay, but you do not see any telegrams displayed. What's wrong? Try this:

- Check that **CAN monitoring** is ON (see **status bar**, “MON”).
- Check that the CAN driver is not “offline” (see status bar, “offline” instead of “online”). You should have seen an error message during initialization.
- Check that the **CAN card** installed on your PC is really there. You should have seen an error message during initialization if that was not the case. If the PEAK CAN driver is used, you find “driver” in the status line if **CANpro** has found a driver but no hardware.
- Check that there is a CAN cable connecting the CAN card of **CANpro** with the machine you are testing.
- Do a Reset Card to reset the CAN card or CAN dongle, especially if the CAN cable has recently been connected.
- Check the CAN cable. If it has not been used before, it may not be properly connected. Otherwise, it may be broken. If the cable is missing or broken, you may find the system comment “!! CAN Driver: a bus error occurred.” in the protocol file.
- Check the **CAN parameters** are correct. If the baud rate is not the same for machine and **CANpro**, you cannot receive any telegrams. An indication for a wrong baud rate is the system comment “!! CAN Driver: a bus error occurred.”



- Depending on CAN cable length, you may need a terminating resistance on one end or on both sides.

If you are **simulating** without monitoring, start CAN monitoring and make the same checks. If you are trying to **load the flash PROM**, change to CAN monitoring and make the same checks.

### **Memory Problems**

If **CANpro** reports lack of main memory during execution, there may be too many files open, especially too many old **protocol files** opened in “read only”. Close them!

You may have **forgot closing other applications**. Close them! Remember that **CANpro** needs a good quantity of extra memory so the system does not get into rapid page swapping, what would cause a fatal degradation of execution speed.

### **Disk Space Problems**

If you open a new **protocol file** and there is not enough disk space left to store a completely full protocol, an error message is given. Try to find obsolete files and remove them from disk before going on testing.

### **CAN Driver or Card Errors**

If the **CAN card** is not installed, if it fails or the CAN driver is not properly installed, this will be noticed and reported to you during initialization. There are only errors in relation to bus overload and driver overload you may receive during monitoring and simulation.

Receive queue overrun: **CANpro** does not read the telegrams as fast as they arrive. Possible causes:

- There are other applications running on the PC.
- The PC's processor frequency is too slow for the baud rate used (see **CAN parameters**).
- **CANpro** itself is sending too many telegrams with too few pauses (this can happen only if there are a lot of telegrams arriving from the CAN bus and at the same time **CANpro** itself is constantly sending at full speed).

If you are doing **Flash Loading** or **Flash Reading**, and **CANpro** is **monitoring** at the same time, this error can occur if the PC is not very fast. If you stop the monitor, the error should disappear.

Transmit queue overrun: The telegrams sent by **CANpro** are not transmitted to the CAN bus, or not so fast as **CANpro** sends. Possible causes:

- **CANpro** itself is sending too many telegrams with too few pauses, in comparison with the baud rate used (see CAN Parameters).

Bus error: The CAN card reports a bus error. Possible causes:

- A reset of the hardware (bus error reported only once, not important).
- The baud rates on the CAN cards of some participants on the CAN bus do not match. In this case, no telegrams are received from the CAN bus. See **CANpro cannot send or receive telegrams**.

Hardware overrun: The CAN controller (hardware) sometimes cannot read the telegrams from the CAN bus. Possible causes:

- Under Windows98, on a notebook or PC with a power management installed, the power management may be preventing the CAN driver from properly handling its interrupts. Please uninstall the power management in the system BIOS!
- If there is no power management at all, there may be a different kind of driver conflict, with a driver using the same interrupt as the CAN dongle (== the interrupt that is assigned to the parallel interface you are using for the CAN dongle). Probably you can change in BIOS or in system control the interrupt of the other driver.

**END OF MANUAL**